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## Population dynamics of Papaya mealybug, *Paracoccus marginatus* Williams and Granara de Willink on three different host plant

**M Hazarika and SK Dutta**

### Abstract

The population of *P. marginatus* showed positive relationship with max. temperature, min. temperature and BSSH. Rainfall, relative humidity (morning and evening) and wind velocity showed significant negative relationship on all the three host plants during 2017, while the population of *P. marginatus* showed positive relationship with max. temperature, min. temperature and BSSH. Rainfall, relative humidity (Morning and evening) and wind velocity showed significant negative relationship on all the three host plants during 2018. *P. marginatus* is an important pest of papaya and it has got two other commonly available host plants- mulberry and acalypha.

**Keywords:** *Papaya mealybug, papaya, mulberry, acalypha, meteorological parameter*

### Introduction

The papaya (*Carica papaya* L.) is one among the important delicious and popular fruit crops grown throughout India. It's originated in Mexico and spread to most the corners of the tropical and subtropical parts of the globe. It's a brief duration and year-round fruit in Assam. Though it's mostly cultivated in homestead gardens many farmers have commercial cultivation in several regions of Assam. As a raw fruit, it's popularly used as vegetable in cooking and a few other preparations. Papaya fruit is a rich source of minerals, vitamins, and enzymes. It's an amazingly rich source of the proteolytic enzymes. These are the chemicals that enable the digestion of protein. Papain, the foremost important of these enzymes within the papaya, is extracted and dried as a powder to be used to assist the digestion, and it's often used as a meat tenderizer, the enzyme partially breaks down the meat fibers. Mulberry (*Morus alba* L.) is a fast-growing, small to medium-sized tree which grows to 10–20 m tall. It's generally a short-lived tree with a lifespan reminiscent to humans, although there are some specimens known to be over 250 years old. The species is native to northern China, and is widely cultivated and naturalized elsewhere (United States, Mexico, Australia, Kyrgyzstan, Argentina) Mulberry is additionally vulnerable to attack by a variety of insect pests. *Acalypha wilkensisiana* L. is also known as copper leaf, large, fast growing evergreen shrub, which may provide endless splash to modify the landscape with the bronze red to muted red and mottled combinations of 15 green, purple, yellow, orange, pink or white (Gilman 1999)<sup>[3]</sup>. It's believed to be native to Fiji and nearby Pacific islands. Acalypha is grown in many parts of the US (USDA 2007)<sup>[11]</sup>. Aphids, mites, scales, and mealybugs are recorded as pests of acalypha (Gilman 1999)<sup>[3]</sup>. The assembly of papaya is greatly hindered by a nuisance insect pest, papaya mealybug (PMB) *Paracoccus marginatus* Willam and Granara de Willink (Hemiptera: Pseudococcidae) in Assam. The papaya mealybug caused heavy infestation and reduced yield of papaya and devastated the crop throughout the country within the recent past. This species is a devastating exotic polyphagous sucking insect with high multiplication and spreading potentials at field level. It is native to Mexico and Central America, where it never acquires the status of a heavy pest, probably due to the presence of an endemic natural enemy complex (Tanwar *et al.*, 2010)<sup>[10]</sup>. The specimens of this mealybug were collected in 1955, but it had been only described in 1992 (Williams and Willink, 1992)<sup>[12]</sup>. Papaya mealybug was first found in 1992 from the Neotropical region in Belize, Costa Rica, Guatemala, and Mexico. PMB became a pest when it invaded the Caribbean region. Since 1994 it's been recorded in 14 Caribbean countries. The pest was recorded in Bradenton, Florida in 1998 on *Hibiscus* and by 2002 it spread to 18 different plant species in 30 different cities. The establishment of this pest

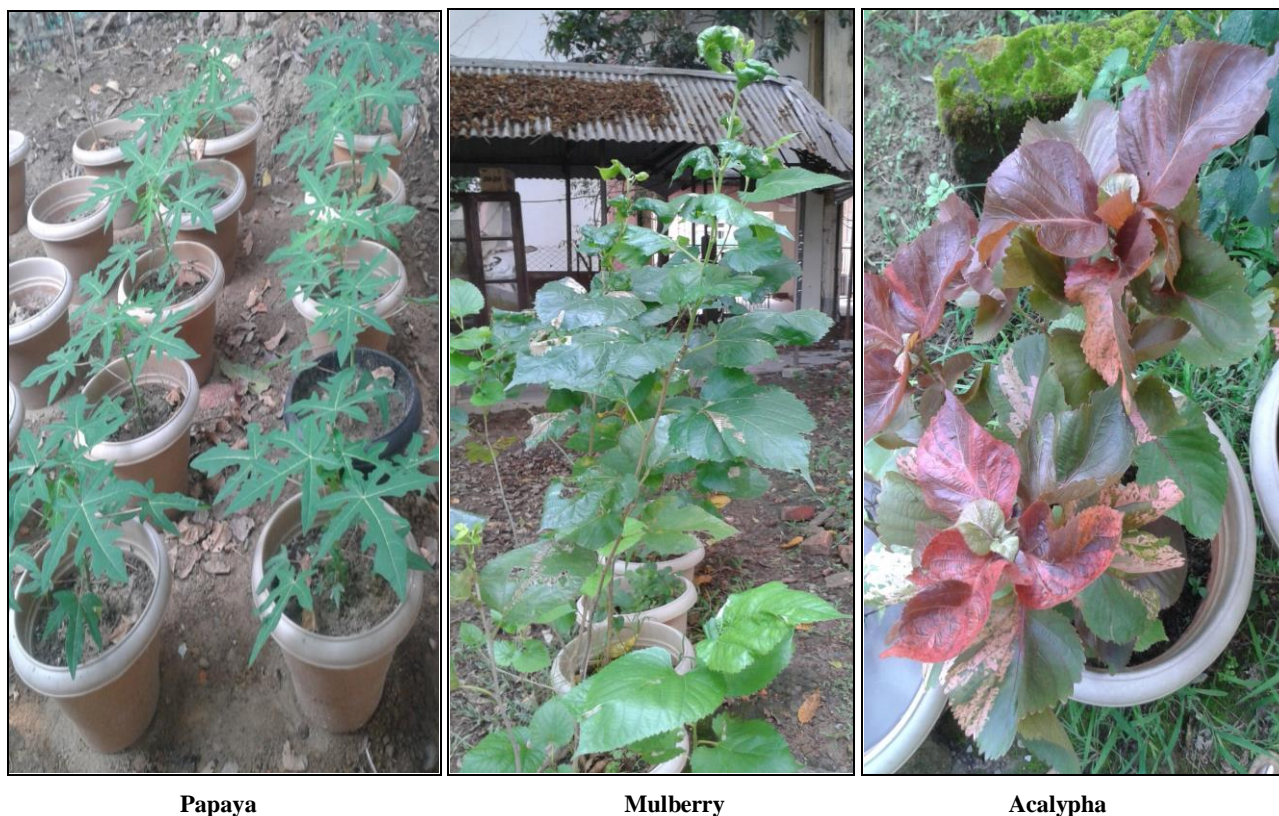
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in Guam in 2002 and Palau in 2003 resulted in further spread to neighbouring archipelago within the Pacific. In Asia, it was reported from Indonesia, India and Sri Lanka in 2008 (Muniappan *et al.*, 2009)<sup>[5]</sup>, Maldives and Bangladesh in 2009 and Thailand, Cambodia and also the Philippines in 2010. It had been also reported from the Reunion Island within the Arabian Sea and Ghana in geographic region in 2010 and Assam in 2013 (Sarma, 2013)<sup>[6]</sup>.

This exotic pest has recently invaded many districts of Assam presumably through infested fruit of papaya. There are reports of moderate to severe attacks of this pest on papaya and plenty of other fruits, vegetables and decorative plant from many parts of the state. However, besides preliminary surveys for incidence of this pest and its natural enemies, not much of work has been initiated within the state to this point. Keeping in sight the menace it would cause to horticultural crops in Assam in near future, the present study was undertaken to understand the trend of growth of papaya mealy bug on three different host plants and to estimate the influence of abiotic and biotic environmental factors on papaya mealy bug population.

### Materials and methods

The absolute population trend of *P. marginatus* and the incidence of damage was recorded in the selected host plants *viz.* papaya (var. Swapna), mulberry (var. Kanva2) and acalypha (var. Luisiana Red) (Figure 1). Freshly emerged crawlers obtained from laboratory cultures were released on fifty potted plants each of papaya, mulberry and acalypha kept outdoors in a partially shading place. Weekly observations on absolute population of the mealybug were counted on four leaves each from five randomly selected plants of each host plants. The natural enemy populations were also recorded whenever observed. Observations were taken at weekly intervals starting from 1<sup>st</sup> Jan. to 31<sup>st</sup> Dec. of 2017 and 2018. Meteorological parameters, *viz.*, maximum and minimum temperatures, relative humidity (morning at 08.30 am and evening at 13.30 pm), rainfall, bright sunshine hours (BSSH) and wind velocity for the entire period of study were collected from the Meteorological Observatory of the Department of Agrometeorology, Assam Agricultural University, Jorhat during 2017 and 2018.



**Fig 1:** Selected host plants

### Results and discussions

The data on the incidence of *P. marginatus* during 2017 in papaya, mulberry and acalypha are diagrammatically represented in Figure 3, 4 and 5 respectively. The build-up of *P. marginatus* population was observed from second week of Jan. 2017 to Dec. 2017. The incidence of *P. marginatus* in January was initially low with a population level of 43.00 numbers of *P. marginatus* per leaf on papaya, 40.00 numbers and 37.00 numbers of *P. marginatus* per leaf on mulberry and acalypha. The population of the pest was observed to boost almost steadily upto early April. The primary peak population of the pest was recorded on 8<sup>th</sup> April with a mean population of 156.00 numbers per leaf on papaya, 150.00 numbers per leaf on mulberry and 145.00 numbers per leaf on acalypha.

Thereafter the population reached several (6-7) peaks amid fluctuation to succeed in this highest peak on 4<sup>th</sup> November altogether the hosts (Figure 2). The highest peak populations recorded on 4<sup>th</sup> November were 189.00 per leaf on papaya, 181.00 per leaf on mulberry and 178.00 per leaf on acalypha (Figure 5). During the preceding week, the maximum and minimum temperatures were 30°C and 17.8°C with 95.5 per cent (morning) and 67 per cent (evening) relative humidity. Lack of rainfall with bright sunshine hours 9.6 and wind velocity 1.0 kmph prevailed during this week. The different weather parameters probably were congenial for multiplication and colonization of the pest. The population was seen to declined and reached low level on 24<sup>th</sup> June. After attaining the last and highest peak on 4<sup>th</sup> Nov. the population

almost sharply declined to a level of 45.00 on papaya, 41.00 on mulberry and 40.00 on acalypha. This abrupt decline was mainly due to onset of cold weather as minimum temperature showed a steady fall since 4<sup>th</sup> Nov. till 31<sup>st</sup> Dec., 2017. Shreedharan *et al.* (1989) [7] reported that the mealybug, *Planococcus citri* was severe in summer season (March-July) and no incidence was there in winter season (October-November) in Mandarin orange (*Citrus reticulata*). Suresh *et*

*al.* (2010) [9] also reported that seasonal incidence of *P. solenopsis* population was maximum (35 mealybugs/5 cm) during June and decreased slowly during September and there was no incidence up to February. Gaikwad *et al.* (2018) [2] reported that the insect *P. marginatus* was prevalent throughout the year and maximum population was recorded in the 18<sup>th</sup> meteorological week.

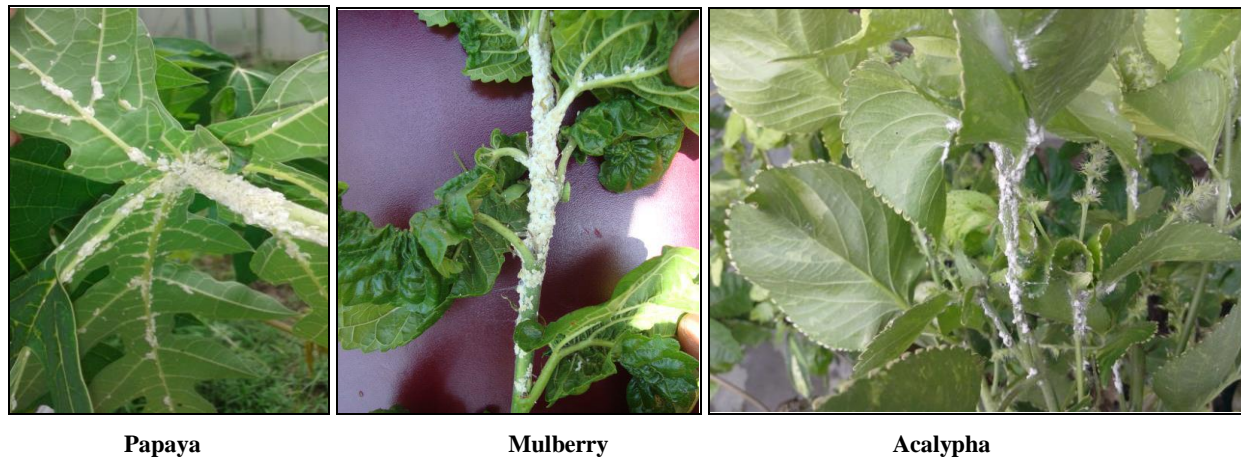


Fig 2: Population of *P. marginatus* during peak incidence period

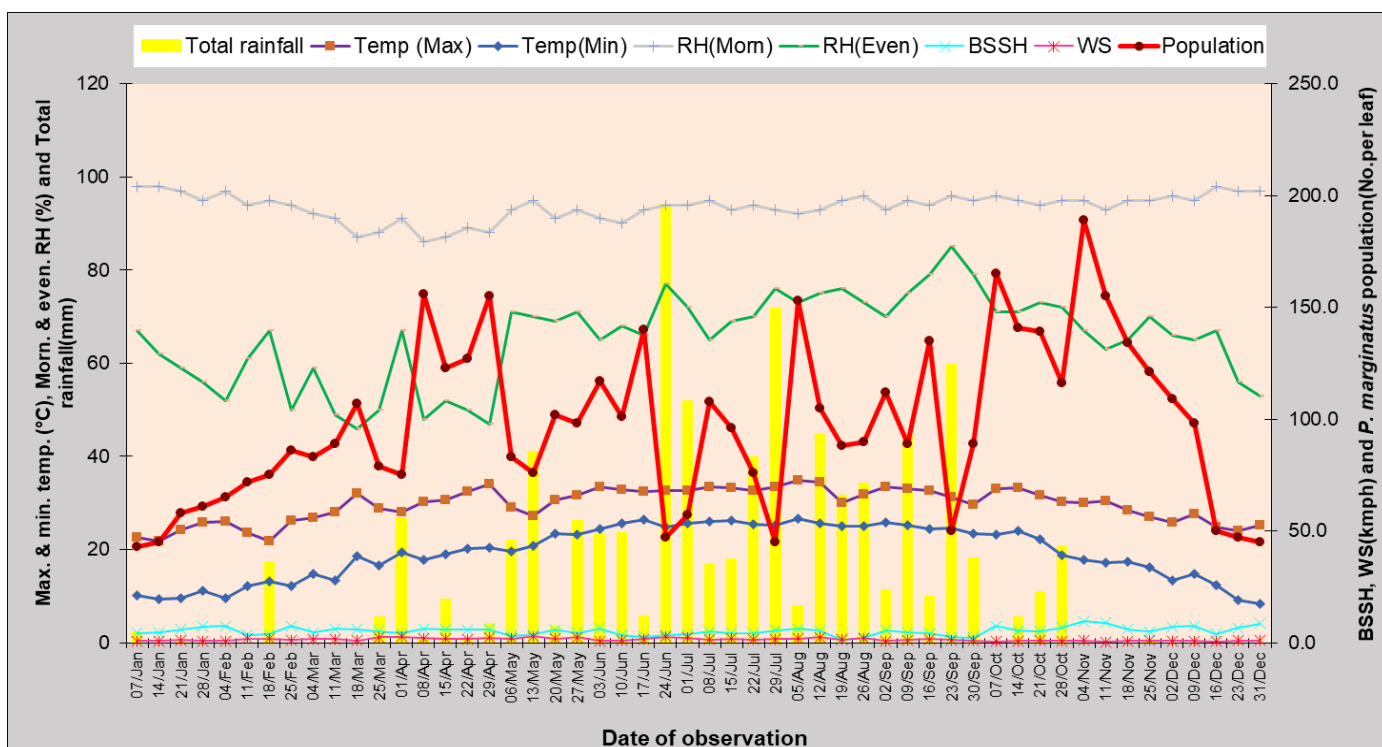


Fig 3: Populations build up of *P. marginatus* in papaya 2017

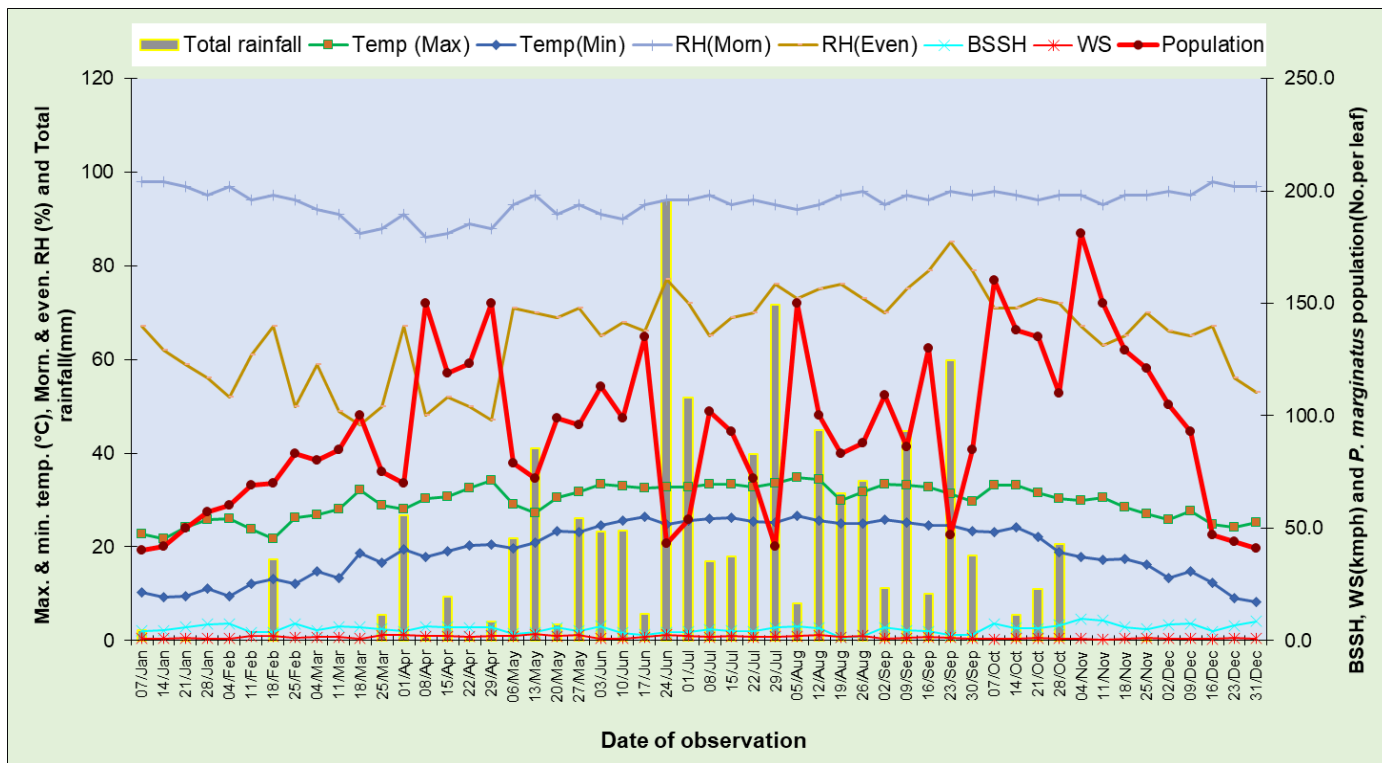


Fig 4: Populations build up of *P. marginatus* in mulberry 2017

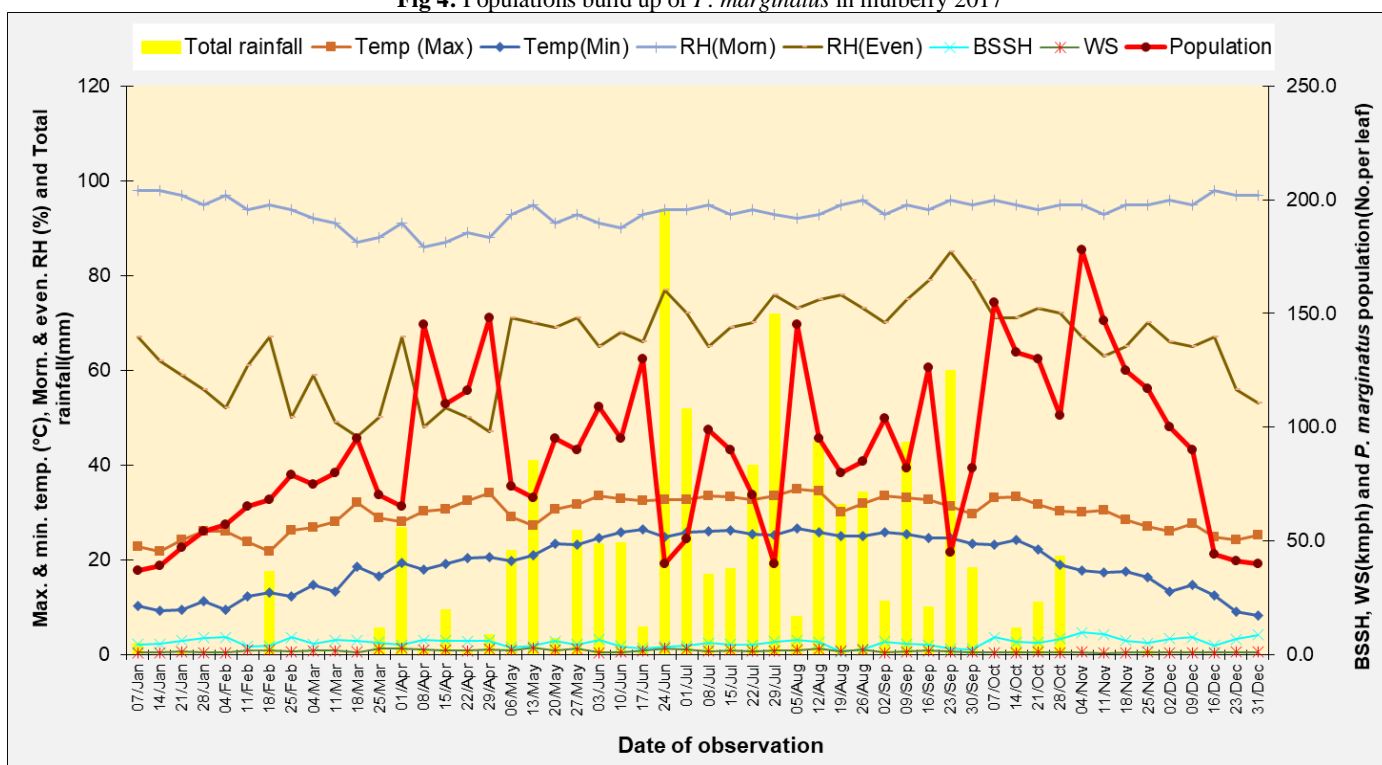


Fig 5: Populations build up of *P. marginatus* in acalypha 2017

The incidence of *P. marginatus* during 2018 in papaya, mulberry and acalypha are diagrammatically represented in Figure 6, 7 and 8 respectively. The build up of *P. marginatus* population was observed from first week of Jan. 2018 to Dec. 2018. The incidence of *P. marginatus* in January was initially low with a population level of 43.00 numbers of *P. marginatus* per leaf on papaya, 40.00 numbers and 35.00 numbers of *P. marginatus* per leaf on mulberry and acalypha. The population of the pest was observed to raise almost steadily upto late April. The first peak population of the pest was recorded on 29<sup>th</sup> April with a mean population of 138.00

number per leaf on papaya, 134.00 number per leaf on mulberry and 130.00 number per leaf on acalypha. The highest peak populations recorded on 7<sup>th</sup> October were 189.00 per leaf on papaya, 185.00 per leaf on mulberry and 180.00 per leaf on acalypha. During the preceding week, the maximum and minimum temperatures were 34.4°C and 25°C with 92.00 per cent (morning) and 72 per cent (evening) relative humidity. Lack of rainfall with bright sunshine hours 5.7 and wind velocity 0.7 kmph were observed. The different weather parameters probably were congenial for multiplication and colonization of the pest. The population

was seen to be declined and reached low level on 29<sup>th</sup> July. After attaining the last and the highest peak on 7<sup>th</sup> October, the population almost sharply declined to a level of 45.00 on papaya, 40.00 on mulberry and 40.00 on acalypha. Mani and Thontadarya (1987)<sup>[4]</sup> found that the population built from the mealy bug, *Meconellicoccus hirsutus* in vineyards was heavy from January to May and low from June to December in South India. Cham *et al.* (2011)<sup>[1]</sup> reported that the population dynamics of the invasive papaya mealy bug, *P. marginatus* is higher densities in the dry season than in the wet season on both fruits and leaves. Abiotic factors such as rainfall, temperature and relative humidity as well as habitat type were found to influence the dynamics and distribution of *P.*

*marginatus* with more effects on crawlers and adults than on egg sacs and on fruits than leaf. Seni and Sahoo (2015)<sup>[8]</sup> found that the population of, *P. marginatus* incidence on papaya was higher in the 2<sup>nd</sup> and 3<sup>rd</sup> week of May and the population declined gradually and increased again in October month and lower population was found in January. Maximum temperature showed a positive and significant correlation with the mealy bug population, while the ratio showed a correlation and relative humidity showed a negative correlation. The above study revealed that moderate temperature with long dry periods coupled with longer period of bright sunshine favoured the build-up of this pest.

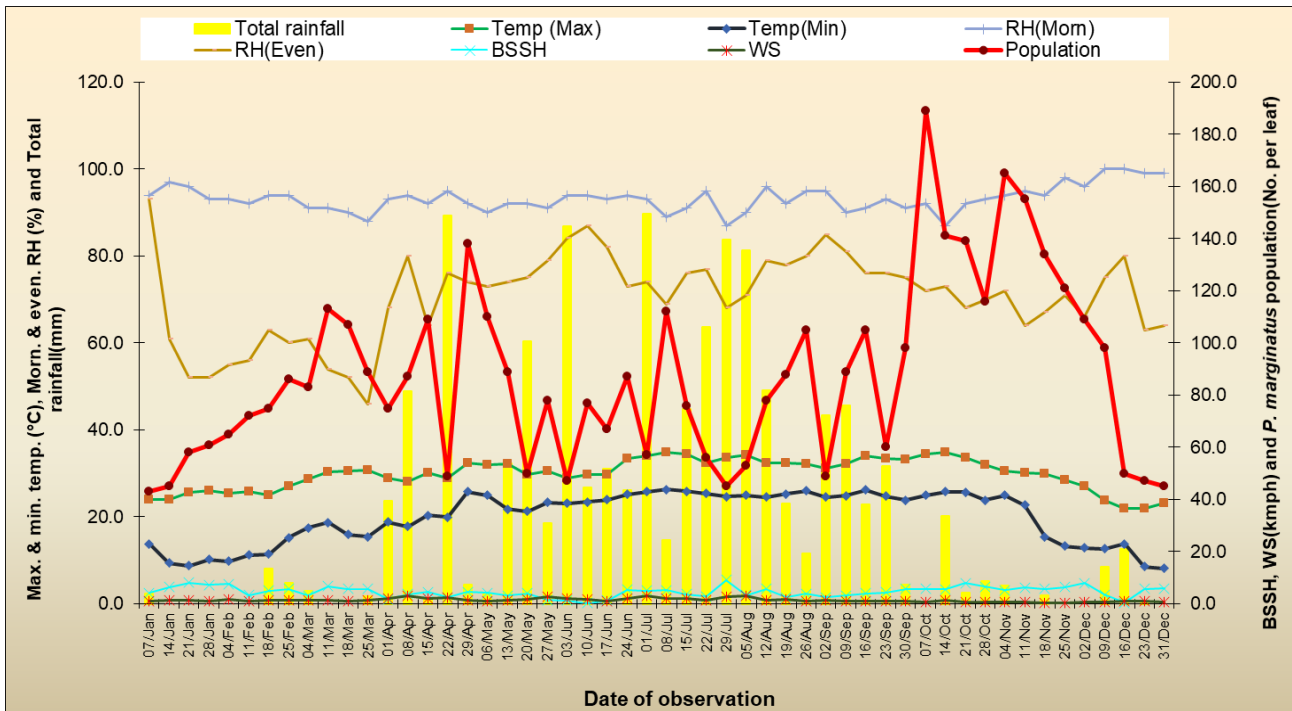


Fig 6: Populations build up of *P. marginatus* in papaya 2018

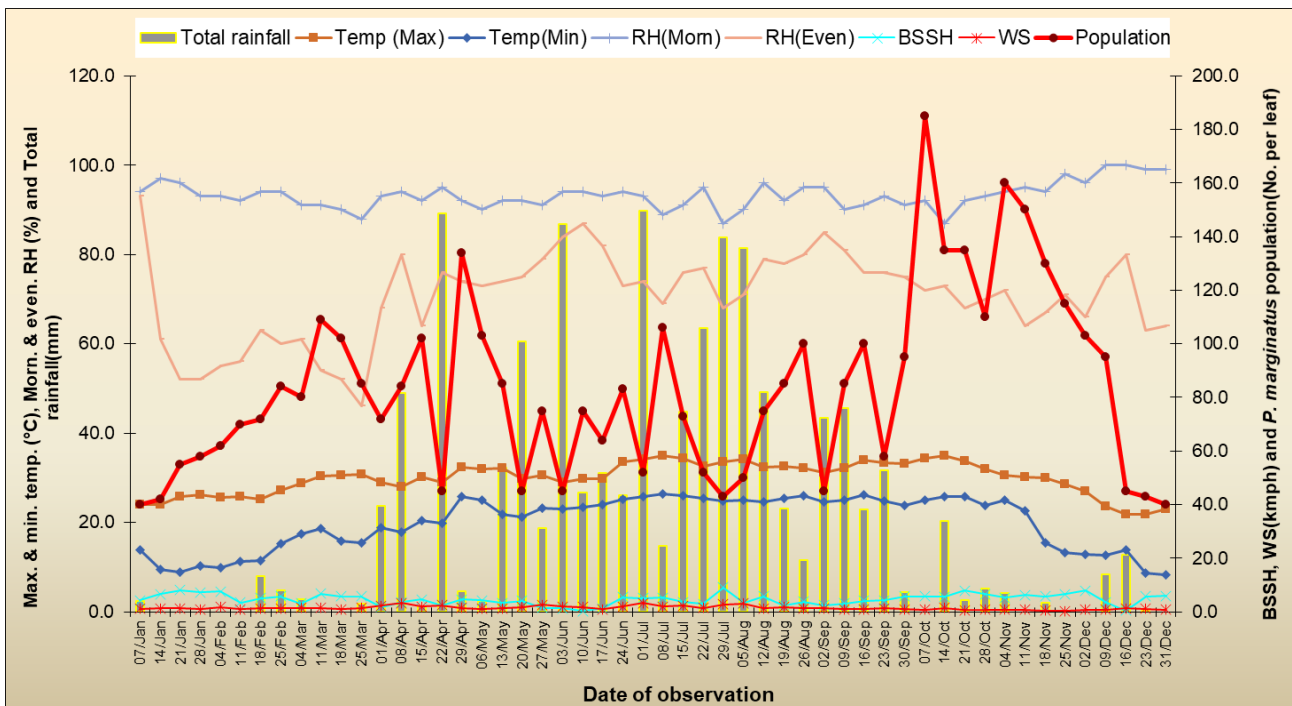


Fig 7: Populations build up of *P. marginatus* in mulberry 2018

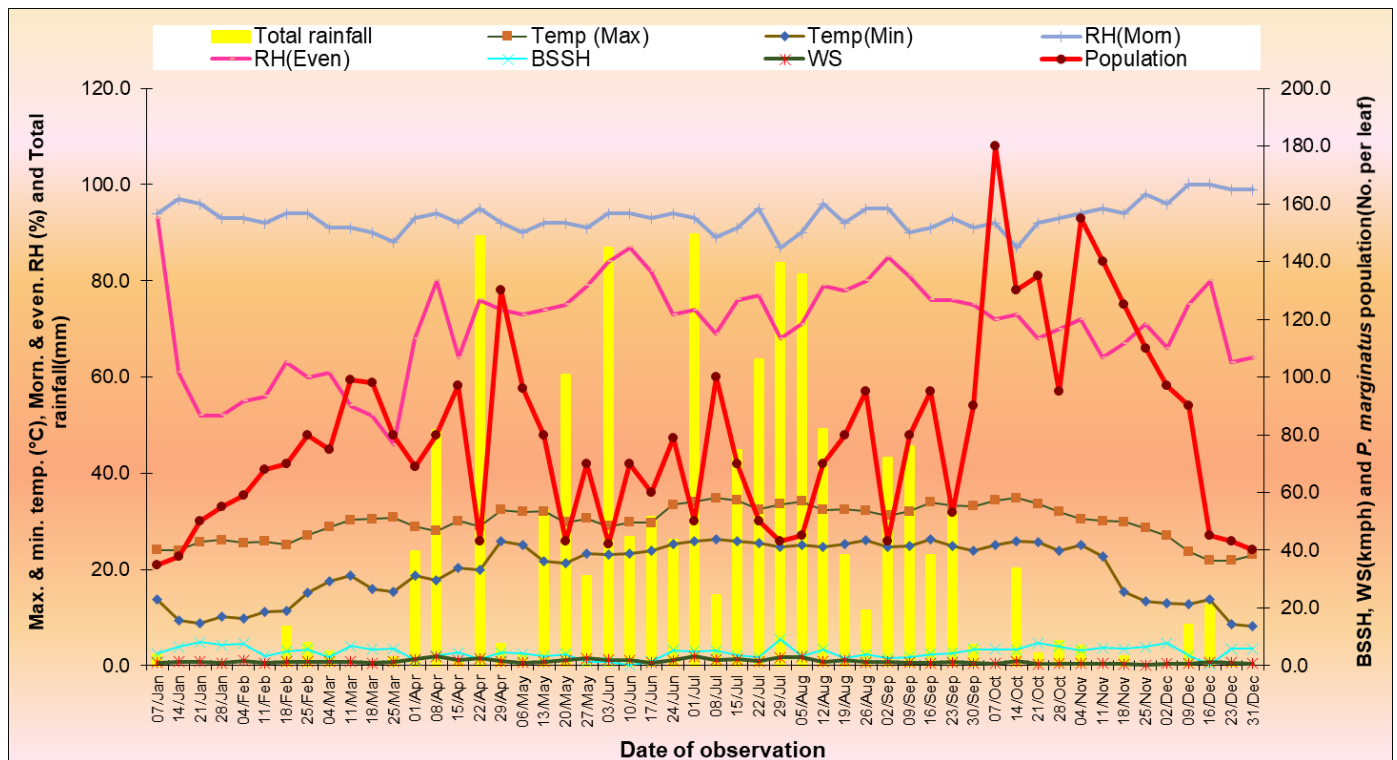


Fig 8: Populations build-up of *P. marginatus* in acalypha 2018

### Conclusion

From the present investigation it can be concluded that *P. marginatus* is an important pest of papaya and it has got two other commonly available host plants- mulberry and acalypha. *P. marginatus* is a serious sap sucking pest prevalent on all the three host plants throughout the year causing major devastation, particularly in papaya.

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